Chapter 3 Incorporated Freeway Management System Infrastructure Components

A full FMS project may be implemented either as a *stand-alone* project along an existing section of freeway where no civil improvements are involved, or as an integrated project with civil improvements, typically a mainline widening. Regardless of stand-alone or integrated status, the design of the full FMS most likely involves every chapter of this guideline. The FMS infrastructure includes the following field elements, with the design of each addressed later within this guideline:

- Communications trunk conduit system – Chapter 4
- Vehicle detector station – Chapter 5
- Ramp meter and other FMS cabinets – Chapter 6
- Dynamic message signs (DMS) – Chapter 7
- Closed-circuit television (CCTV) cameras – Chapter 8
- Communication Nodes and Node Buildings – Chapter 9
- Fiber-optic Cable Outside Plant (OSP) Design and Modeling – Chapter 10

3.1 FMS Infrastructure with a Roadway Project

The FMS infrastructure elements shall be considered an integral part of the freeway design. As a minimum in each project, the designers should include trunk conduits, pullboxes and detection. These elements are place below ground or in the pavement and as such should be constructed with the freeway or freeway widening. This constitutes the "plumbing" of the FMS system.

The trunk conduit system extends along the mainline freeway corridor and provides the primary method of distributing fiber-optic communications cabling and power conductors for the system. The conduit system also includes pullboxes placed along the mainline conduit system.

The pullboxes are required to interconnect the field devices with the communication and power cables, and to facilitate in the installation and maintenance of the freeway management system.

Where new pavement is to be an installed, preformed loop detector are required to be placed beneath the pavement section. Loops in this case are placed along the freeway mainline, and on entrance ramps.

In some instances, other elements of the FMS design, such as ramp meters, cabinet foundations, DMS foundations, CCTV foundations, controller cabinet platforms, or special conduit connections must also be provided for within the roadway design. These additional FMS elements are required when elements of the roadway design, (such as retaining walls, sound walls, long bridges, median barrier, etc.); make it impractical or excessively costly to complete the necessary installation during a future FMS implementation project. Blisters for DMS signs, pullbox locations and lateral crossings of the freeway

should be strategically placed to accommodate future devices. The designer should consider the criteria presented in this guideline for placement of the infrastructure.

3.2 FMS Infrastructure Stand-Alone Projects

When FMS Infrastructure is designed as a stand-alone project the designer bears a greater responsibility for planning documents, clearances and conformance to the ADOT project management process. Coordination with other agencies and local utilities is the responsibility of the designer.

The designer typically starts with a planning document such as a PA that takes the project to 30% design including an estimate and discussion of design alternatives considered. The document will show preliminary device locations in sketch format and identify any special considerations, such as local agency involvement, special clearances needed and special geographic concerns. The document should include a general project schedule for design and construction. Base mapping is generally not required at this stage.

Clearances required included environmental, utility, and right of way. Where projects occur on Native American lands special permits may need to be obtained. Special permits or clearance may also be needed for railroad, state parks, flood control districts and connections to city facilities. The designer must be aware of these items and budget for them in the schedule. Joint project agreements (JPA) or Intergovernmental agreements (IGA) may be needed to reimburse costs for enhancements desired by outside agencies.

Typical ADOT FMS projects require submittals for 60%, 95% and 100% design. The submittals shall include plans, specifications and estimate for distribution by the designer. Regular progress meetings as well as comment resolution meetings shall be held for each project. The designer must submit estimates in the ADOT E2C2 format and provide a schedule detailing the 21 milestones tracked by ADOT. Requests for utility service drops are typically the responsibility of the designer and may require on site meetings with the utility company providing service.

Prior to the kickoff meeting, the designer should meet with the ADOT TTG project manager (PM) to discuss stakeholders, statements of work, schedule, scope and budget. Traffic control will typically be the responsibility of the designer including traffic control for bucket truck surveys and field surveys. Special field surveys may be needed for specific devices such as DMS. Where unique structural designs are required the designer must involve the ADOT structures group.

ADOT FMS maintenance and ADOT FMS construction, through the Vision Field office, play an important part in plan and specification review. Their input was extensive in the production of these guidelines and must be included for each project designed.

The designer should plan on conducting a meeting post design with the Vision Field office to present the project to the construction inspectors. In addition, the designers continued involvement through construction as part of post design services is desired. As-builting and providing a final computer aided design disc after construction is also a design responsibility.

This section outlines basic designer responsibility and is intend for information, but is not all inclusive.

3.3 Emerging Technology

Other technologies for FMS infrastructure may be considered in the design provided they have been approved by the ADOT Transportation Technology Group (TTG). A listing of current ADOT approved technologies appears on the *APL* (*Approved Products List*) following the *PRIDE* (*Product Resource Investment Deployment and Evaluation*) process. The PRIDE process is administered by the ADOT Transportation Planning Division's *Arizona Transportation Research Center*. Due to the technological nature of FMS, research projects can be proposed by designers for inclusion in current project plans.

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